Facility Name and Location

Bitterroot Valley Sanitary Landfill
Ravalli County, Montana

Statement of Basis and Purpose

This decision document presents the selected remedy for the Bitterroot Valley Sanitary Landfill (BVSL) Comprehensive Environmental Cleanup and Responsibility Act (CECRA) facility in Ravalli County. This decision is based on the Administrative Record file for this facility. The complete Administrative Record is available for public review at the Montana Department of Environmental Quality (DEQ), Remediation Division, 2209 Phoenix Avenue, Helena, Montana. Portions of the administrative record are available at the Farmers State Bank, 103 Main Street, Victor, Montana, and at the Bitterroot Public Library, 306 State Street, Hamilton, Montana.

Assessment of Facility

Between 1981 and 1985 a known 2935 kilograms of laboratory wastes including volatile organic compounds, metal salts, and phenol were disposed of in a pit in the southwestern corner of the BVSL. These actions led to onsite and offsite groundwater contamination including the contamination of residential wells. The BVSL facility boundaries, as determined by the Department of Environmental Quality (DEQ) Remediation Division, encompass the BVSL historic waste disposal pit and any place where hazardous or deleterious substances have come to be located. It includes the areas containing the plume of contamination of chloroform at a level in excess of 1 microgram per liter in groundwater. This remedy does not address the remainder of the landfill that falls outside of this boundary and the landfill remains subject to all applicable laws, including those relating to solid waste landfill closure and monitoring. The remedial actions selected in this Record of Decision (ROD) are necessary to protect public health, safety, welfare and the environment from actual or threatened releases of hazardous or deleterious substances into the environment.

Description of Selected Alternative

The selected cleanup alternative for the BVSL facility includes the design and construction of a community water supply system (CWSS), implementation of institutional controls (ICs), natural attenuation and groundwater monitoring. Following is a brief description of each of the major components of the selected cleanup alternative. Numerous interim cleanup actions have been performed at the facility since facility investigations began. These actions are not considered part of the selected alternative because they have already occurred. Soil remediation is not addressed in this ROD because it was included in the source removal interim cleanup action. Surface water, stream sediment and air are also not addressed in this ROD because contamination has not been detected in these media.

Major components of the selected alternative:

Community Water Supply System

A CWSS will be designed, constructed and connected to each home and business within the facility boundaries, the 35 gallon per minute pumping buffer zone boundary of the proposed controlled groundwater area (CGWA), or with existing deep replacement wells. The CWSS will provide residents and workers with clean drinking water.

Institutional Controls

ICs, preferably a CGWA, will be implemented to limit the installation of new domestic use and high yield wells within the facility boundaries and buffer zone (Appendix F). If the CGWA is not approved by the Department of Natural Resources and Conservation, the remedy will require the placement of other appropriate ICs to prevent or limit access to groundwater on property within and adjacent to the facility boundaries.

Natural Attenuation

Natural attenuation is currently occurring at the BVSL facility and will continue. The source of contamination was removed in 1993 and 1994. A groundwater pump and treat system was installed in 1994 and enhanced in 1998. With the exception of one recovery/interception well (R-9D), all other recovery/interception wells are exhibiting a tailing phenomenon (Appendix A, Figure 9) that indicates the system is becoming less effective at removing any residual contamination. Other technologies to address contaminated groundwater were evaluated but it was determined that no other current technologies are available that would meet CECRA's remedy selection criteria. DEQ expects natural attenuation to continue and, within a reasonable amount of time, reduce the contaminant concentrations to cleanup levels.

Groundwater Monitoring

Groundwater monitoring will be conducted to evaluate water quality and to evaluate if the plume migrates beyond the CWSS or IC boundaries until cleanup levels are met. If the plume migrates beyond the CWSS or IC boundaries, the CWSS or ICs will be expanded.

Statutory Determinations

The selected remedy assures present and future protection of public health, safety, and welfare and the environment, and complies with federal and state environmental requirements, criteria, or limitations that are applicable or relevant to the selected remedy and facility conditions. The selected remedy mitigates exposure of risks to public health, safety, and welfare, and the environment, is effective and reliable in the short and long-term, is technically practicable and implementable, uses engineering controls, and is cost-effective.

[Original Copy Signed]__________________________ 01/24/2002________
Jan P. Sensibaugh Date
Director
Montana Department of Environmental Quality

DECISION SUMMARY

FACILITY NAME, LOCATION, AND BRIEF DESCRIPTION

The Bitterroot Valley Sanitary Landfill (BVSL) facility is located in the Bitterroot Valley of western Montana (Appendix A, Figure 1) approximately one mile south of the town of Victor in Ravalli County (Township 8 North, Range 20 West, Section 31). The BVSL facility boundaries, as determined by the Department of Environmental Quality (DEQ) Remediation Division, encompass the BVSL historic waste disposal pit and any place where hazardous or deleterious substances have come to be located. It includes the areas containing the plume of contamination of chloroform at a level in excess of 1 microgram per liter (μg/L) in groundwater (Appendix A, Figure 2). The facility boundary changes as the plume changes. This remedy does not address the remainder of the landfill that falls outside of this boundary. The landfill remains subject to all applicable laws, including those relating to solid waste landfill closure and monitoring.

Residential and commercial areas lie within the facility boundaries. Residences are located northeast, east and south of the former landfill property. All businesses and residences in the area have private wells. There are no zoning restrictions within the facility boundaries.

FACILITY HISTORY AND ENFORCEMENT ACTIVITIES

BVSL, Inc. began landfilling operations in 1966 serving Hamilton and northern Ravalli County (Ecology and Environment, Inc. [E&E] 1991). In 1978, the landfill was granted a Montana solid waste management license to accept Group II and III wastes, excluding septic pumpings and liquid wastes. This permit conditionally allowed the disposal of small quantities of hazardous wastes in amounts not to exceed 100 kilograms (kg) per month per waste generator or a total of 200 kg per month at the BVSL. Based on available records, the National Institutes of Health's (NIH's) Rocky Mountain Laboratory located in nearby Hamilton disposed of at least 1295 kg of hazardous waste between 1981 and 1985. Ribi Immunochem Research, Inc. (Ribi) disposed of at least 1640 kg of immunological waste between 1981 and 1985. Monthly reports submitted to the Montana Department of Health and Environmental Sciences (DHES) indicated that a variety of volatile organic compounds (VOCs), metal salts, and phenol were disposed of onsite (Appendix B).

The laboratory wastes were disposed of in a waste disposal pit in the southwestern corner of the landfill. According to Charles Mann, the landfill owner, the pit was approximately fifteen feet wide by five feet long by ten feet deep (E&E 1991).

Following a recommendation by the DHES Solid Waste Management program, Charles Mann, in 1982, initiated a groundwater monitoring program that utilized four monitoring wells. In 1985, disposal activities of the hazardous wastes were discontinued because monitoring results showed that downstream wells may be exhibiting lower quality water than the background water supply (DHES 1985).

In 1985, the Environmental Protection Agency (EPA) conducted a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) preliminary assessment of the BVSL. The preliminary assessment indicated that further investigations were required. In

1988, the EPA conducted a CERCLA site inspection and in 1991, it presented a final listing site inspection prepared by E&E. Results of these investigations confirmed that the groundwater was contaminated. Although the facility is a National Priorities List (NPL) caliber facility, it has never been proposed for listing on the NPL.

In 1991, results of potentially liable person (PLP) searches concluded that Ribi, NIH, Charles Mann and BVSL, Inc. were PLPs under Montana's Comprehensive Environmental Cleanup and Responsibility Act (CECRA) law. After receiving a general notice letter from DHES, BVSL, Inc. provided bottled water to affected and potentially affected residents at the facility because the federal maximum contaminant levels (MCLs) were exceeded for 1,1-dichloroethene, 1,2-dichloroethane, dichlorodifluoromethane, chloroform, methylene chloride, tetrachloroethene, trichloroethene and vinyl chloride within the plume that extended onto adjacent residential and commercial property.

In 1992, NIH voluntarily initiated a "Hydrogeologic Characterization of the BVSL, Ravalli County, Montana" to determine the nature and extent of the contamination. This report was finalized in February 1993. At the BVSL facility, the hydrogeologic characterization serves as part of the remedial investigation because it contains the same information that would be contained in a remedial investigation.

As a voluntary action, NIH investigated the location of the historic waste disposal pit in 1993 and released the resulting report in October of that year (Huntingdon 1993a). This document is also included as part of the remedial investigation. In 1993 and 1994, NIH conducted a source removal interim cleanup action. Approximately 18,000 cubic yards of non-contaminated overlying material and 57,000 cubic yards of soil and overburden contaminated with chloroform and other VOCs were excavated from the waste disposal pit area totaling 75,000 cubic yards removed (Maxim 1996). The contaminated soil was placed on a polyvinyl chloride liner that covered an area about 99,000 square feet. The soil was mixed by a bulldozer to expose the soil to the air to allow the contaminants to evaporate. The treated soil was returned to the excavated area and the land was then reclaimed to its previous condition (Maxim Technologies, Inc. [Maxim] 1996). Sampling was conducted before the material was excavated and before returning it to the excavated area. Maxim determined that approximately 24 kilograms of chloroform were removed, which was determined to be approximately 97 to 98 percent of the original chloroform in the soil at that time (Maxim 1996). Twenty-four kilograms is an estimate as chloroform is a volatile compound and evaporates readily when exposed to air, and some chloroform may have been lost due to collecting, containerizing and preparing the soil samples (Maxim 1996).

In 1994, DEQ prepared a risk assessment (RA) through its contractor, Camp Dresser & McKee (CDM) to determine the pathways of exposure and risks associated with the contamination. The risks are discussed in detail in the <u>Summary of Facility Risks</u> section of this ROD.

Also in 1994, NIH voluntarily initiated a phase one groundwater remediation project. Contaminated groundwater was pumped by two recovery/interception wells and discharged through two sprinklers at a land discharge unit (Maxim 1995). This system was used yearly between late April and mid-October, the non-freezing months. Phase IIA of the groundwater remediation system included the installation of six recovery/interception wells in July of 1998 (Maxim 2001a). This system also included replacing land application via sprinklers with an air stripper. Contaminated groundwater is pumped to the air stripper, treated to non-detectable levels and discharged through a pipe to the North Channel of Bear Creek. Because the water is treated inside and the piping is underground, the system can run year round. In March of 2000, one last recovery/interception well, making nine recovery/interception wells total, was activated full time (Maxim 2000). As of September 2001, the pump and treat system had recovered approximately 50 kilograms of chloroform (Maxim 2002).

NIH voluntarily initiated the feasibility study (FS) process. NIH presented DEQ with a "Final Draft Preliminary Alternatives Analysis, BVSL, FS, Ravalli County, Montana" prepared by Huntingdon Chen-Northern, Inc. (Huntingdon) in March 1994 (PAA). The PAA includes a list of seventeen alternatives that was refined and reduced to include methods that might be effective, implementable, and cost-effective based on facility specific contaminant characteristics and facility conditions. The list of alternatives was further refined and narrowed as a result of public comment. NIH conducted a detailed analysis of the most effective and implementable alternatives and incorporated it into the "Draft Final Feasibility Study, BVSL, Ravalli County, Montana" prepared by Huntingdon in October 1994.

Between January and March of 1995, NIH voluntarily conducted "An Additional Hydrogeologic Study Report, Alternative Water Supply, BVSL." One alternative in the FS included an alternate drinking water supply option consisting of individual water supply wells completed in a deeper aquifer beneath the facility. Because a deeper aquifer was being considered as a drinking water supply, NIH conducted the study to further investigate the lower aquifer (Huntingdon 1995). This report also serves as part of the remedial investigation. Also in 1995, NIH voluntarily began installing 19 interim deep replacement domestic wells for the affected parcels at the facility. (One parcel received two replacement wells but only one is being used for domestic purposes; therefore, the Record of Decision [ROD] will refer to 19 replacement wells.) These replacement wells were drilled into deeper aquifers. The groundwater from these replacement wells contains high levels of naturally occurring iron and manganese, making the water non-potable without treatment. Therefore, to make the water potable, NIH installed individual treatment systems on the occupied parcels.

In April 1997, DEQ filed a complaint in the Montana First Judicial District Court against Ribi, BVSL, Inc., and Charles Mann. In April 1998, DEQ signed a consent decree with Charles Mann and BVSL, Inc. wherein these parties settled their liability with the State by paying $34,500 and agreeing to provide access to landfill property and to implement, maintain, and comply with ICs. The parties also received contribution protection under CECRA for matters addressed in the settlement. On May 5, 1998, the First Judicial District Court signed the consent decree and it became effective.

In June 1998, NIH submitted an "Amendment to Draft Final FS, BVSL, Ravalli County" to include two new alternatives. One of these alternatives included groundwater withdrawal and treatment by air stripping. The other alternative included deep source area soil flushing using cosolvents or surfactants to enhance contaminant removal by increasing the apparent solubility of the contaminant in groundwater. In 1998 and 1999, NIH voluntarily initiated a Phase IIB Groundwater Remediation Source Area Characterization and Laboratory Bench Testing to determine if cosolvent/surfactant flushing was a feasible alternative for the BVSL facility. In order for cosolvent/surfactant flushing to be feasible, the location of dense non-aqueous phase liquid (DNAPL) must be known because the cosolvents/surfactants increase the solubility of the

DNAPL. No DNAPL was discovered in the deep portion of the upper aquifer during the source area characterization and therefore the cosolvent/surfactant flushing project was discontinued (Maxim 1999).

In April 1998, the United States (US), on behalf of NIH, filed a complaint in the US District Court for the District of Montana, Missoula Division, against Ribi, BVSL, Inc., Charles Mann, and Mary Louise Mann. DEQ intervened as a plaintiff in that lawsuit against the US and Ribi. In March 1999, the US signed a consent decree with Charles Mann, Mary Louise Mann, and BVSL, Inc. wherein these parties settled their liability with the US by paying $440,000. The parties also received contribution protection under CERCLA for matters addressed in the settlement. This consent decree was lodged with the District Court and was subject to a 30 day public comment period. On May 28, 1999, the District Court signed the consent decree and it became effective.

In early 1999, NIH sent notices to residents informing them they would be responsible for maintaining the individual treatment systems on their deep replacement wells. On March 27, 1999, DEQ issued a Unilateral Administrative Order to NIH and Ribi requiring them to continue the operation and maintenance of the individual treatment systems on the interim replacement wells.

On October 6, 1999, Corixa Corporation (Corixa) acquired all of the outstanding shares of Ribi, and Ribi ceased to exist as a separate corporate entity.

In November 2000, the US and DEQ signed a settlement agreement wherein the US settled its liability with DEQ by paying $15,000 and agreeing to implement and/or fund the final remedy selected by DEQ. NIH also received contribution protection under CERCLA for matters addressed in the settlement. Also in November 2000, the US and DEQ signed a consent decree with Corixa wherein Corixa settled its liability with the US by paying $2.2 million and with DEQ by paying $450,000 for past and future remediation costs. Corixa paid NIH $1.1 million for past remediation costs and $1.1 million for future remediation costs. The money for the future remediation was placed into an escrow account and NIH will use this money to fund the final cleanup at the facility. The consent decree was lodged with the District Court and it, along with the settlement agreement, were subject to a 30 day public comment period. On January 26, 2001, the District Court signed the consent decree and it, along with the settlement agreement, became effective.

In addition, NIH has fully funded several investigations, the source removal action, pump and treat system, installation of the deep domestic wells, and maintained the individual treatment systems on those wells, spending between $5 and $5.5 million.

In September 2001, DEQ issued the Proposed Plan (PP) (DEQ 2001) presenting DEQ's preferred alternative for final remediation at the facility. The 30 day public comment period for the PP was held from September 4, 2001 through October 3, 2001.

COMMUNITY PARTICIPATION

The first public meeting held by DEQ regarding the BVSL facility was on April 2, 1991 to inform residents and business owners of the background and status of the facility. In September

1991, DEQ sent out a fact sheet covering activities at the facility. In February 1993, DEQ sent out a fact sheet to everyone on the BVSL facility mailing list to update the public on what activities were being conducted and the results of investigations.

On April 6, 1994, an open house and public meeting were held by DEQ to discuss the status of the PAA and the RA. DEQ provided a public comment period concerning the RA and PAA from April 7, 1994 to May 9, 1994. On May 4, 1994 a public hearing was held to receive comments on the RA and PAA. A legal ad announcing the public comment period and public hearing was published in the Ravalli Republic and Missoulian newspapers on April 3, 1994. A postcard mailing was also sent to everyone on the BVSL facility mailing list. DEQ issued a responsiveness summary to the comments in June 1998. Most comments from residents regarded their opposition to installing a community water supply system and that health considerations should be the priority. DEQ responded, noting that DEQ's top priority is always the residents' health and that their comments would be taken into consideration.

DEQ provided notice of the public comment period for the FS November 8, 1994 in the Missoulian. DEQ also sent out fact sheets to everyone on the mailing list. An informal public meeting was held November 9, 1994 to discuss the FS alternatives with the public. The public comment period for the FS was held from November 10, 1994 to December 12, 1994 with a public hearing held November 30, 1994. A responsiveness summary to the FS comments was issued in June 1998 (DEQ 1998). Comments were received from eight individuals and two companies. Many of the commenters indicated they would prefer the PLPs purchase the affected properties. In the responsiveness summary, DEQ indicated that there is no legislative directive that would require this to happen. Under CECRA, condemnation may occur but only in last resort situations, which is not the situation at the BVSL facility (DEQ 1998).

In accordance with § 75-10-713, MCA, DEQ provided notice of the public comment period, public meeting and hearing in the Ravalli Republic and Missoulian newspapers on the PP for the BVSL facility on September 4, 2001. DEQ also sent fact sheets prior to the public meeting and hearing to everyone on the BVSL facility mailing list, including the Ravalli County Commissioners. An article concerning the BVSL facility and the PP was on the front page of the Ravalli Republic on September 4, 2001. KPAX-TV aired a story about the BVSL facility and PP on September 6, 2001 on the 5:30 p.m. and 10:00 p.m. news. The public meeting and hearing were held on September 18, 2001 at the Victor Public School. The 30 day public comment period for the PP was held from September 4, 2001 through October 3, 2001.

Notice of the ROD will be published and copies of the ROD will be made available to the public for review at the repositories. The ROD will also be made available on the DEQ website (http://www.deq.state.mt.us). Appendix C of the ROD is the responsiveness summary, which provides a response to each of the comments submitted in writing or orally at the hearing during the public comment period on the PP.

DEQ received comments from nine commenters during the public comment period on the PP. None of these comments gave DEQ a reason to select a different cleanup alternative. Five commenters indicated they were in favor of choosing a CWSS as the selected alternative. Four were in favor but had several concerns such as what happens if something fails in the first year, who would be connected to the system, and who would fund operation of the system. DEQ has responded to each comment in the responsiveness summary contained in Appendix C.

The complete Administrative Record (that contains all documents related to the selection of the remedy for the BVSL facility) is located at:

Department of Environmental Quality
Remediation Division
Hazardous Waste Site Cleanup Bureau
2209 Phoenix Avenue
Helena, MT 59620-0901
406-444-1420
Monday – Friday: 8 a.m. – 5 p.m.

Portions of the Administrative Record are located at:

Bitterroot Public Library
306 State
Hamilton, MT 59840
406-363-1670
Tuesday & Wednesday: 10 a.m. – 8 p.m.
Thursday: 12 p.m. – 8 p.m.
Friday: 12 p.m. – 5 p.m.
Saturday: 10 a.m. – 5 p.m.

Farmers State Bank
103 Main Street
Victor, MT 59875
406-642-3431
Monday – Thursday: 8:15 a.m. – 5 p.m.
Friday: 9 a.m. – 6 p.m.

SCOPE AND ROLE OF REMEDIAL ACTION

This ROD addresses groundwater contamination at the facility because groundwater is the only remaining contaminated medium that poses any risk to human health or the environment. Contact with water extracted from the contaminated aquifers poses a potential current and future risk to human health (CDM 1994) because cleanup levels are exceeded. In order to reduce these risks, DEQ is including the following cleanup actions in the ROD:

- Installation of a community water supply system (CWSS)
- Implementation of institutional controls (ICs)
- Natural attenuation
- Groundwater monitoring

Based on findings from previous investigations, DEQ believes that current data and information are adequate for DEQ to evaluate and select an appropriate remedy for the facility. The ROD contains cleanup levels for all known contaminants of concern (COCs).

The cleanup choice outlined in this ROD represents the final cleanup action at the BVSL facility. Previously completed interim cleanup actions are not considered part of the final selected alternative because they have already occurred.

FACILITY CHARACTERISTICS

Geology and Soil

The Bitterroot Valley is bordered by mountains composed of igneous, metamorphic and sedimentary rocks. The valley is composed of erosional products from the surrounding mountains (Huntingdon 1993) with possible sediment thickness of 1500 feet in some areas (Finstick 1986). Surface soils in the Bitterroot Valley are stony and gravelly coarse sandy loams with loams present in the coulee bottoms (Soil Conservation Service 1975).

Groundwater

The BVSL facility is approximately one-half mile in length, reaching from the historic waste disposal pit to the Bitterroot River. The hydrogeology of the BVSL facility is complex. Groundwater generally moves in an east/northeasterly direction and flows into the Bitterroot River drainage. The groundwater system contains four main aquifer layers, each divided by a clay aquitard, which is a discontinuous sedimentary feature that reduces groundwater flow (Appendix A, Figure 3). Contamination at the BVSL facility is located in the uppermost aquifer called unit A, which is divided into the shallow part of unit A that ranges from about 10 to 65 feet below ground surface (bgs) and the deeper part of unit A, which ranges from about 80 to 120 feet bgs. Contamination is also located in wells BR-GW-61DD and D-39 in unit B, which ranges from about 125 to 200 feet bgs. Unit B contains one deep domestic replacement well that is not currently contaminated. No contamination has been detected in unit C, which ranges from about 245 to 275 feet bgs. Unit C contains three deep domestic replacement wells. Most of the deep domestic replacement wells are located in the lowermost aquifer called unit D, which ranges from about 250 to 275 feet bgs. Iron and manganese, detected at high levels in the lower units, have narrative standards listed in Montana's water quality standards (WQB-7) based on EPA's secondary MCL standards for drinking water. A secondary MCL is a standard based on taste, odor, staining or other aesthetic properties. The secondary MCL for iron is 0.3 milligrams per liter (mg/L) and 0.05 mg/L for manganese. These secondary MCLs and WQB-7 narrative standards are exceeded in all 19 replacement wells before treatment at the individual wellheads for iron and in fifteen wells for manganese. Currently, 16 wells are being used. Four wells exceed iron standards and eight exceed manganese standards after treatment (Appendix D, Maxim 2001d). The iron and manganese in the lower units are naturally occurring.

Because of the high levels of iron and manganese, each residence or business with a deep replacement well has a treatment system. Maintenance is one problem with individual treatment systems. Residents at the facility have indicated to DEQ that sometimes their individual treatment systems are not maintained on a regular schedule. When the maintenance is not regular, staining of sinks, showers and toilets has occurred. Clothing has also been stained when regular maintenance is not kept up. Outdoor yard decorations have been discolored from sprinkling. In one instance, hair was discolored. Another problem with individual treatment systems is bacteria growth (DiGiano 1992). If the systems are not maintained on a regular basis, bacteria may form within the system and cause greater health risks than that caused by the groundwater contamination.

Each layer of the aquifer is composed of different materials. Unit A is composed of sand and gravel with cobbles. Unit B is generally fine to coarse sand with several clayey silt lenses. Unit C is sandy with numerous thin silt and clay lenses. Unit D consists of gravels with sand, to silty sand with gravel (Maxim 1997).

Appendix I contains pumping test data obtained during various studies (Maxim 2001c). Included in this information is hydraulic conductivity and transmissivity for each unit. Hydraulic conductivity is a value representing the relative ability of water to move through a geologic material of a given permeability (Weight and Sonderegger 2001). The hydraulic conductivity in the shallow portion of unit A ranges from 2 to 185 feet per day. The hydraulic conductivity in the deep portion of unit A ranges from 1 to 20 feet per day. The hydraulic conductivity in unit B ranges from 21.8 to 23 feet per day. The hydraulic conductivity in unit C ranges from 1.4 to 9.9 feet per day. The hydraulic conductivity in unit D ranges from 0.53 to 21 feet per day.

Transmissivity represents the ability of a given thickness of an aquifer under a given gradient to transmit fluids (Weight and Sonderegger 2001). The transmissivity in the shallow portion of unit A ranges from 60 to 9706 feet squared per day. The transmissivity in the deep portion of unit A ranges from 21.9 to 509 feet squared per day. The transmissivity in unit B ranges from 262 to 276 feet squared per day. The transmissivity in unit C ranges from 43 to 296 feet squared per day. The transmissivity in unit D ranges from 2.67 to 528 feet squared per day.

Surface Water

Data collected during the hydrogeologic characterization study indicates groundwater and surface water interact throughout the BVSL facility (Huntingdon 1993). The North Channel of Bear Creek gains water from the groundwater in some areas and loses water to the groundwater in other areas. There is also an unnamed ephemeral drainage that runs in a northeasterly direction east of Highway 93 that periodically contains water. The North Channel of Bear Creek and the ephemeral drainage both drain to the Bitterroot River. The Bitterroot River is the ultimate recipient of all near-surface groundwater in the Bitterroot Valley (Huntingdon 1994a). There are two ponds at the facility: a large pond located east of Highway 93 near the North Channel of Bear Creek and a small pond also east of Highway 93.

Natural Attenuation

Natural attenuation uses naturally occurring environmental processes to clean up contamination. The processes of natural attenuation include biodegradation, dilution, dispersion and adsorption. At the BVSL facility, most likely due to the transmissive nature of unit A, dilution and dispersion are reducing contaminant concentrations. The effects of dilution and dispersion appear to reduce contaminant concentrations but do not destroy the contaminant (EPA 1996). Relatively clean water can mix with and dilute contaminated groundwater. Clean groundwater from underground locations flowing into contaminated areas, or the dispersion of contaminants as they spread out away from the main path of the contaminated plume, also lead to a reduced concentration of the contaminant in a given area (EPA 1996).

Natural attenuation is often used after partial or full source removal of contamination has occurred, which is the case at the BVSL facility. Chloroform concentrations in groundwater in the upper unit of aquifer immediately downgradient of the historic waste disposal pit have attenuated as a result of the interim remedial actions (Maxim 1995a, Huntingdon 1995a). DEQ believes natural attenuation is occurring at the BVSL facility based on data trends from the monitoring wells. Although there are a limited number of monitoring wells near the Bitterroot River, groundwater monitoring data indicates the plume in the deep portion of unit A is slowly dispersing east toward the Bitterroot River. While contaminant concentrations just east of Highway 93 are generally decreasing, the contaminant concentrations closer to the Bitterroot River are generally increasing (Figure 4). This shows that the plume of contamination present when the pump and treat system began was divided. One portion is being contained by the pump and treat system and the other has migrated toward the Bitterroot River and naturally attenuated, leaving relatively cleaner water behind it. An example of this can be shown with wells BR-GW-9 and BR-GW-34D. Well BR-GW-9 had a peak concentration of 329 μg/L in 1996 and has slowly been decreasing since that time. Well BR-GW-34D, which is east and slightly north of well BR-GW-9 has been generally increasing since 1992.

Appendix A, Figure 10 is a plume map of the shallow portion of unit A from January 1994. Appendix A, Figure 6 is a plume map of the shallow portion of unit A from July 2001. The 1994 plume extends further east and south than the plume in 2001. The pump and treat system began operation in 1994. The southern portion of the plume may have been pulled in toward the wells through the pumping action. Appendix A, Figures 11 and 12 are diagrams of the estimated steady state drawdown and zone of influence of the recovery/interception wells, respectively, both in the shallow portion of unit A (Maxim 2001c). The estimated steady state drawdown and zone of influence of the eastern most recovery/interception wells does not extend as far east as the 1994 plume. The contamination in the shallow portion of unit A beyond the influence of the pump and treat system is no longer present, demonstrating that natural attenuation is occurring at the BVSL facility.

Assuming a finite amount of chloroform remains because the source was removed, this plume will be flushed out of the aquifer. This indicates that all contaminated groundwater at the facility will meet cleanup levels within a reasonable amount of time. Other technologies to address contaminated groundwater were evaluated but it was determined that no other current technologies are available that would meet CECRA's remedy selection criteria.

SAMPLING

Soil

The primary source of contamination at the BVSL facility was waste dumped into a pit at the landfill. These wastes spread into adjacent and underlying soil. During EPA's Final Listing Site Inspection, soil samples were collected in the area of the historic waste disposal pit and analyzed for all known disposed-of substances. Chromium and silver were the only two substances detected in soil in addition to VOCs at levels higher than background levels. The levels of chromium (0.0326 milligrams per kilogram [mg/kg]) and silver (0.1107 mg/kg) are below EPA's soil screening levels (SSLs) (E&E 1991). DEQ uses SSLs, based upon the potential for contaminants to migrate from the soil to groundwater, to determine if further action is warranted.

Because the chromium and silver levels were below the SSLs, no further action regarding these substances was warranted.

In 1993, approximately 18,000 cubic yards of non-contaminated overlying material and 57,000 cubic yards of soil and overburden contaminated with chloroform and other VOCs were excavated from the waste disposal pit area totaling 75,000 cubic yards removed. Confirmation soil samples were collected after the excavation was complete. Chloroform concentrations in the remaining soil ranged from <0.005 mg/kg to 0.108 mg/kg. These concentrations are below the cleanup level of 0.3 mg/kg in soil (table 6). The contaminated soil was treated onsite through aeration then returned to the excavated area and the land was then reclaimed to its previous condition. The most recent soil sampling event occurred in late 1998 and early 1999 during the source area characterization study. Samples taken from the former waste disposal pit were non-detect for chloroform (Maxim 1999).

Groundwater

Groundwater sampling at the BVSL facility began in 1982 by the landfill operator. There have been many groundwater sampling events since that time. Groundwater is currently the only contaminated medium of concern at the BVSL facility. Currently, Maxim, NIH's consultant, conducts groundwater sampling for VOCs semi-annually in monitoring wells at the facility. Residential wells are sampled annually for VOCs, iron and manganese. Contamination has been detected in the shallow and deep portions of unit A and in two wells in unit B. A complete spreadsheet of sampling results since 1992 is contained in the January/February 2001 semi-annual groundwater monitoring report (Maxim 2001a).

Figures 6 and 7 in Appendix A show the aerial extent of the dissolved chloroform plume in the shallow and deep portions of unit A. Based on the latest available data (Maxim 2001b), the chloroform plume in the shallow and deep portions of unit A has been captured primarily west of Highway 93 as a result of installation and enhancement of the groundwater pump and treat system. However, prior to the enhancement of the system, contamination in the deep portion of unit A was not captured and the plume primarily east of Highway 93 has continued to migrate extending toward the Bitterroot River.

To date, chloroform has been detected in unit B in wells BR-GW-61DD and D-39. This may be due to chloroform migrating downward from unit A to unit B through the discontinuous aquitards. No COCs have been detected in the lower units, although these units contain high levels of naturally occurring iron and manganese.

Surface Water

Surface water samples were collected and analyzed in 1990 during the Final Listing Site Inspection by E&E and also in 1993 and 1994 by Huntington, NIH's consultant. Samples were obtained from the North Channel of Bear Creek, the Bitterroot River and the unnamed ephemeral drainage. In the first surface water sampling event, several contaminants were found in the water, but contaminants were also detected in the trip blanks (E&E 1991). A trip blank is a "clean" sample usually of distilled water that is otherwise treated the same as other samples taken from the field and is used for quality control purposes. Trip blanks are submitted to the laboratory along with all other samples and are used to detect any contaminants that may be introduced during sample collection, storage, analysis, and transport (EPA). During the second and third surface water sampling events, no contaminants were detected in the water (Huntingdon 1993 and 1994). The RA concluded that the contaminants detected initially were laboratory contaminants and not from the facility contamination (CDM 1994). In September 2001, DEQ sampled the large pond within the plume of contamination east of Highway 93. No contaminants were detected in the samples.

Sediment

Stream sediment samples were collected during the 1991 Final Listing Site Inspection investigation and also during the Hydrogeologic Characterization Study in 1992. During the first investigation, several contaminants were detected. Again, contaminants were detected in the trip blanks. During the second investigation, no contaminants were detected in the stream sediment samples. The RA concluded that the contaminants detected initially were laboratory contaminants and not from the facility contamination (CDM 1994).

Soil Gas

Soil gas sampling was conducted between May and June 1993. On the landfill property, chloroform soil gas was detected at concentrations between 0.0075 parts per million (ppm) and 9.1 ppm, which are all above the risk-based concentration of 0.002 ppm for chloroform reported in the RA. However, these concentrations were detected at depths of 25 feet or more below ground surface and will not pose a risk to human health because restrictive covenants on the landfill property will prohibit any type of excavation, including the construction of residences and businesses. Sampling was also conducted off the landfill property; chloroform was not detected in any of the samples.

CURRENT AND POTENTIAL FUTURE LAND AND WATER USES

Land Uses

Currently, the land at the BVSL facility has multiple uses. The landfill itself is vacant and DEQ will require the property owner to file restrictive covenants on the property to prohibit its future development. The landfill has been capped and revegetated. The solid waste program at DEQ requires that once a landfill is capped and closed, the cap cannot be destroyed and vegetation must remain on the cap at all times (DEQ 2001a). In addition, the restrictive covenants to be placed on the property (Appendix H) will prohibit irrigation. Adjacent to the landfill on the east side is a waste transfer station and a small mechanical shop. One other business at the facility is a log home company. The remaining areas of the facility are individually owned parcels of land. There are no zoning regulations at the facility. The historical use of the facility was residential and commercial. The pattern of development in the area is growth. The Bitterroot Valley is growing with residential areas and businesses. Home and business owners at the facility have indicated anticipated land uses will be the same as today. Therefore, DEQ has determined that future land uses are expected to be similar to current land uses.

Groundwater and Surface Water Uses

The North Channel of Bear Creek is an intermittent creek that is the main drainage near the BVSL facility and discharges into the Bitterroot River. This creek is used for irrigation during the late spring, summer and early fall months (Huntingdon 1993). The Bitterroot River on the eastern edge of the facility is a popular fishing and recreational river in Montana.

The groundwater at the facility is used as a domestic water source for area residents and businesses. Each home and business has an individual well. When contamination was detected above MCLs at the BVSL facility, residents who were affected or could potentially be affected were provided bottled water. In 1995, NIH began installing interim deep domestic wells to all affected or potentially affected residents and businesses at the facility at that time. Currently at the facility, one residence, its well in unit A, is using the contaminated groundwater as its domestic water source, but it has a well head treatment system that is treating the contamination to non-detectable levels in the drinking water. Once contaminant concentrations in the groundwater at the facility reach cleanup levels, water use may be unrestricted.

SUMMARY OF FACILITY RISKS

The RA for the BVSL facility was completed in 1994. It provides a basis for taking action and concludes which exposure pathways need to be addressed by cleanup action. The RA serves as the baseline for indicating what risks do or could exist if no further cleanup actions were taken at the facility.

Identification of Contaminants of Concern

The COCs were selected based on the frequency of detection, toxicity, comparison of facility chemical concentrations with background concentrations, and comparison with risk based concentrations for drinking water and Safe Drinking Water Act (SDWA) MCLs (CDM 1994). Based on potential risks to human health, the high levels present in the groundwater and its prevalence throughout the plume, chloroform is the primary COC at the BVSL facility for groundwater (CDM 1994). However, the table below lists all the COCs at the facility.

TABLE 1
CONTAMINANTS OF CONCERN

1,1 Dichloroethene	Dichlorodifluoromethane	Tetrachloroethene
1,2 Dichloroethane	Carbon Tetrachloride	Trichloroethene
cis-1,2-Dichloroethene	Chloroform	Vinyl Chloride
Benzene	Methylene Chloride	

Exposure Assessment

The goal of the exposure assessment is to estimate reasonable maximum exposures (RMEs) in the absence of any future remedial actions for populations that may be exposed to contaminants related to the facility. RME estimates are intended to be protective of at least 95% of an exposed population, but are still believed to be within the realm of possible exposures. Potential routes by which individuals may be exposed to facility-related contaminants are shown on Figure 5 (CDM 1994). The RA identified current offsite residents, current onsite and offsite workers, future onsite and offsite workers, and future onsite and offsite residents as being potentially exposed to contamination by ingesting, inhaling, or having skin contact with contaminated groundwater. The COCs at the BVSL facility generally have high mobility, high volatility, and low persistence and have not been found to significantly bioaccumulate in plants and animals. Pathways associated with ingestion of locally grown produce and animal products are therefore considered insignificant and were not further evaluated (CDM 1994). Soil gas data was used to evaluate whether exposure to indoor air would be of potential concern. Research has shown that indoor air concentrations would likely be lower than the soil gas concentrations measured. No contaminants were detected in soil gas off the landfill property and therefore the indoor air pathway was not assessed (CDM 1994). Currently, there are no residents on the landfill property and there will be none in the future because use of the property will be restricted.

Toxicity Assessment

The purpose of the toxicity assessment is to examine the potential for each COC to cause adverse effects in exposed individuals and to describe the relationship between the extent of exposure to a particular contaminant and adverse effects. Adverse effects include both carcinogenic and noncarcinogenic health effects in humans. Toxicity criteria for carcinogens are slope factors in units of risk per milligram of chemical exposure per kilogram body weight per day $(mg/kg\text{-}day)^{-1}$. These cancer slope factors are based on the assumption that no threshold for carcinogenic effects exists and any dose, no matter how small, is associated with a finite cancer risk. Table 2 shows cancer slope factors for carcinogenic COCs (CDM 1994). A COC may be both a carcinogen and a noncarcinogen based on its adverse effects.

TABLE 2
CANCER SLOPE FACTORS FOR CARCINOGENIC COCS

Contaminant of Concern	Oral Slope Factor $(mg/kg\text{-}day)^{-1}$	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$
1,1 – dichloroethene	6.0E-01	1.8E-01
1,2 – dichloroethane	9.1E-02	9.1E-02
Benzene	5.5E-02	2.7E-02
Carbon tetrachloride	1.3E-01	5.3E-02
Chloroform	6.1E-03*	8.1E-02*
Methylene chloride	7.5E-03*	1.6E-03*
Tetrachloroethene	5.2E-02	2.0E-03
Trichloroethene	1.1E-02	6.0E-03
Vinyl chloride	1.5E+00	3.1E-02

* = The numbers presented here have changed since issuance of the RA but do not change the protectiveness of the RA.

Toxicity values for noncarcinogens, or for carcinogens that may also cause significant noncarcinogenic effects, are reference doses (RfDs) in units of milligrams of chemical exposure per mg/kg-day. RfDs are estimates of thresholds. Exposures less than the RfD are not expected to cause adverse effects even in the most sensitive populations with continuous exposure over a lifetime. Table 3 lists the reference doses for the BVSL COCs (CDM 1994).

TABLE 3
REFERENCE DOSES FOR COCS

Contaminant of Concern	Oral RfD $(mg/kg\text{-}day)^{-1}$	Inhalation RfD $(mg/kg\text{-}day)^{-1}$
Benzene	3.0E-03	1.7E-03
1,1 - dichloroethene	9.0E-03	9.0E-03
Carbon tetrachloride	7.0E-04	7.0E-04
Chloroform	1.0E-02	8.6E-05
Cis-1,2-Dichloroethene	1.0E-02	1.0E-02
Dichlorodifluoromethane	2.0E-01	5.7E-02
Methylene Chloride	6.0E-02*	2.6E-02
Tetrachloroethene	1.0E-02	1.1E-01
Trichloroethene	6.0E-03	6.0E-03
Vinyl Chloride	3.0E-03	2.9E-02

*** =** The numbers presented here have changed since issuance of the RA but do not change the protectiveness of the RA.

Risk Characterization

Chemical exposure estimates are combined with toxicity values to develop quantitative health risk estimates for exposure to BVSL facility COCs. Both cancer and non-cancer health risks are estimated, as appropriate, for each significant exposure route identified. Risks from different exposure routes are combined to provide a total estimate of carcinogenic and non-carcinogenic health risks. Cancer and non-cancer risks are summarized for each pathway in Tables 4 and 5.

Carcinogens

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. An excess individual cancer risk of 1×10^{-5} indicates that, as a reasonable maximum estimate, an individual has a 1 in 100,000 chance of developing cancer as a result of facility-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at the facility.

The excess individual cancer risk is the additional chance that a person could develop cancer in his lifetime from being exposed to contaminated material. This is risk cumulative of combined exposure to multiple COCs. This risk is in addition to the risk that already exists for the general population of a 1 in 3 chance or higher of developing cancer. Based on § 75-5-301(2)(b)(i), MCA, DEQ considers a 1×10^{-5} or lower excess cancer risk for known or suspected carcinogens as acceptable. Table 4, following, exhibits a summary of total cancer risks by each pathway (CDM 1994). Numbers in bold are above DEQ allowable limits.

TABLE 4
SUMMARY OF TOTAL CANCER RISK BY PATHWAY

Pathway	Receptor							
	• Current Offsite Resident • Future Offsite Resident		• Current Onsite Worker • Current Offsite Worker		• Future Offsite Worker (Deep Portion of the Unit A)		• Future Offsite Worker (Shallow Portion of the Unit A)	
	RME	Average	RME	Average	RME	Average	RME	Average
Groundwater Ingestion	1.3E-05	2.0E-06	5.9E-05	7.0E-06	9.2E-06	7.9E-06	9.0E-04	1.8E-04
Inhalation of Chemicals from Groundwater	9.6E-05	1.5E-05	2.4E-05	3.3E-06	1.5E-04	1.9E-05	8.0E-03	1.6E-03
Dermal Contact With Groundwater	3.8E-06	5.9E-07	1.8E-05	2.1E-06	2.8E-05	2.4E-06	2.7E-04	5.4E-05
Total Cancer Risk	**1E-04**	**2E-05**	**1E-04**	1E-05	**3E-04**	**3E-05**	**9E-03**	**2E-03**

All receptor pathways exceed DEQ's allowable limits. Chloroform and vinyl chloride contribute the most to the current and future scenario RME and average carcinogenic risks.

The Agency for Toxic Substances and Disease Registry (ATSDR) evaluated for DEQ the risks associated with children running through sprinklers using contaminated water and risks associated with adults and children being exposed to chloroform volatilizing by watering lawns with contaminated water. ATSDR determined adverse health effects are not expected as a result of children being exposed to chloroform while playing outdoors with sprinklers. Adverse health effects are also not expected as a result of adults or children being exposed to chloroform while watering lawns (ATSDR 2001a).

DEQ also requested assistance from ATSDR to determine if current levels of chloroform and other VOCs present a health concern to children or adults swimming in the water in an outdoor swimming pool. ATSDR concluded that the exposure would not be expected to result in adverse health effects to children or adults. ATSDR also evaluated the risk of using the water for swimming pools chlorinated by the pool's owner. ATSDR determined that no additional risk would be associated with this use (ATSDR 2002).

Non-carcinogens

The potential for non-carcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., a 70-year lifetime) with a reference dose derived for a similar exposure period for each non-carcinogenic COC. Then cumulative toxic effects for combined exposures of multiple COCs are calculated. The ratio of exposure to reference dose is called a hazard quotient (HQ). The Hazard Index (HI) is calculated by adding the HQs for all COCs that affect the same target organ (e.g., liver) within a medium or across all media to which a given population may reasonably be exposed. Where the HI exceeds one, risks of non-cancer effects may be elevated. DEQ considers a hazard index equal to or less than one for the human population, including sensitive subgroups, as acceptable. Table 5 summarizes the non-

carcinogenic hazard estimates for each pathway. Numbers in bold are above DEQ allowable limits. All RMEs for children are above one. Future adult onsite residents also have an RME above one.

Ecological Risks

The primary aquatic habitats of concern are the North Channel of Bear Creek, an unnamed drainage east of Highway 93, and the Bitterroot River. Depending on season and flow, some of these waters can support aquatic invertebrates, fish and amphibian larvae.

Terrestrial vegetation consists mainly of grasses and weedy species. Dry grasslands with an occasional tree and riparian areas support a wide variety of small animals, including mice, rabbits and squirrels. This area is also home to deer, coyotes, a variety of birds and some reptiles and amphibians. No threatened or endangered species exist primarily at the facility.

Sediment and surface water were sampled and no COCs were found (CDM 1994). Since this primary exposure pathway for ecological receptors is incomplete, any risks to aquatic ecological receptors are unlikely. The only thing that may stress the surrounding ecosystems is the loss of suitable habitat caused by disturbance at the facility. Disturbance occurs from excavation activities and construction activities. Even with this disturbance, because of the abundance of suitable habitat nearby, it is unlikely that large numbers of any particular species have been displaced (CDM 1994). Therefore, cleanup levels protective of human health are adequately protective of ecological receptors in the area.

REMEDIAL ACTION OBJECTIVES

Because contaminated soil was excavated and treated in 1994, human exposure to contaminated soil is considered unlikely. Confirmation soil samples were collected after the excavation was complete. Chloroform concentrations in the remaining soil ranged from <0.005 mg/kg to 0.108 mg/kg. DEQ uses EPA's SSLs, based upon the potential for contaminants to migrate from the soil to groundwater, to determine if further action is warranted. DEQ has determined that a dilution attenuation factor (DAF) of 10 is appropriate for Montana based on soil and climate conditions. Thus, DEQ uses the SSL and adjusts it by the DAF to determine the appropriate screening level. The confirmation soil samples were all below the adjusted SSL of 0.3 mg/kg.

DEQ also uses EPA Region IX's preliminary remediation goals (PRGs), which are based on ingestion, inhalation, and dermal contact and include residential and industrial exposure, to determine if further action is warranted. Risks from contaminated soil are calculated individually for each contaminant and then added together. The risk may be no higher than $1x10^{-6}$ for carcinogens and have an HI no higher than 1 for non-carcinogens. CECRA mandates that where groundwater contamination exists, cleanup efforts must meet applicable or relevant water quality standards. Therefore, the groundwater cleanup levels for the BVSL facility are WQB-7 standards or MCLs for those COCs. WQB-7 standards are usually as stringent as MCLs because they are based on a risk of $1x10^{-5}$. Table 6 is a list of the COCs with their respective water quality standards and PRGs or SSLs. The table reflects the most protective of the two values. The point of compliance is at the source; therefore, groundwater throughout the entire plume must meet cleanup levels.

TABLE 6
CLEANUP LEVELS FOR THE COCS

Contaminant of Concern	EPA PRGs and EPA SSLs+	Montana groundwater quality standard (WQB-7)	EPA MCLs	Risks at Cleanup Level			
				Soil		Groundwater	
				Carcinogenic	Non-Carcinogenic	Carcinogenic	Non-Carcinogenic
1,1 Dichloroethene	0.03 mg/kg•	7 :g/L	7 :g/L	Total for all COCs 1×10^{-6}	Total for all COCs HI=1	$1x10^{-5}$	HI=1
1,2 Dichloroethane	0.01 mg/kg•	4 :g/L	5 :g/L			$1x10^{-5}$	#
cis-1,2-Dichloroethene	0.02 mg/kg•	70 :g/L	70 :g/L			❖	HI=1
Benzene	0.02 mg/kg•	5 :g/L	5 :g/L			$1x10^{-5}$	#
Dichlorodifluoromethane	310 mg/kg*	1400 :g/L	NL			❖	HI=1
Carbon Tetrachloride	0.03 mg/kg•	3 :g/L	5 :g/L			$1x10^{-5}$	HI=1
Chloroform	0.3 mg/kg•	60 :g/L	100 :g/L			$1x10^{-5}$	HI=1
Methylene Chloride	0.01 mg/kg•	5 :g/L	5 :g/L			$1x10^{-5}$	HI=1
Tetrachloroethene	0.03 mg/kg•	5 :g/L	5 :g/L			$1x10^{-5}$	HI=1
Trichloroethene	0.03 mg/kg•	5 :g/L	5 :g/L			$1x10^{-5}$	HI=1
Vinyl Chloride	0.007 mg/kg•	0.15 :g/L	2 :g/L			$1x10^{-5}$	#
Total Trihalomethanes	NL	100 :g/L	80 :g/L			$1x10^{-5}$	HI=1

NL = Not Listed
* = Industrial Soil
• = Soil to Groundwater DAF 10 SSLs
❖ = Cleanup driven by non-carcinogenic effects
= Cleanup driven by carcinogenic effects
+ = The most protective value, either PRG or SSL, is used.

DESCRIPTION OF ALTERNATIVES

Remedy Components

A brief description of the facility cleanup alternatives DEQ considered follows. The estimated present worth cost of each alternative includes capital cost and annual operation and maintenance (O&M) cost. Cleanup action time frames are limited to 30 years for analysis, even for those alternatives requiring perpetual O&M, since costs beyond 30 years have minimal present worth. It is important to realize that the present worth costs do not incorporate the costs of the initial installation of the pump and treat system, soil removal or the installation of the existing domestic wells because these interim actions have already taken place.

NIH presented DEQ with the PAA as prepared by Huntingdon in March 1994. The PAA includes a list of seventeen alternatives that was refined and reduced to include methods that might be effective, implementable, and cost-effective based on facility specific contaminant characteristics and facility conditions. The list of alternatives was further refined and narrowed as a result of public comment. NIH conducted a detailed analysis of the most effective and implementable alternatives and incorporated them in the FS prepared by Huntingdon in October 1994. Since 1994, after the publishing of the FS, additional information has become available regarding the alternatives in the FS. Therefore, DEQ evaluated and combined multiple alternatives from the FS to form the most recent alternatives and incorporated them into the Proposed Plan.

Alternative 1:

- No Action

The no action alternative is used as a baseline against which to compare the other alternatives. No further action would be taken under this alternative.

Alternative 2:

- Individual deep replacement wells with individual treatment systems
- Groundwater monitoring
- Implementation of ICs
- Natural attenuation

Alternative 2 incorporates maintaining the interim deep domestic wells installed by NIH in the lower units, implementing ICs to restrict use of contaminated groundwater, providing for the installation of new deep wells as property is developed (estimated at 103 wells, should property be subdivided into half-acre lots), groundwater monitoring throughout the facility and natural attenuation. As part of this alternative, continued operation of the current pump and treat system, installed in unit A, would not be required because it is no longer effective in treating the contamination. Based upon assessments by various experts at sites similar to BVSL, it is likely that the laboratory solvents disposed of in the historic waste disposal pit migrated through the subsurface to the saturated zone. It is also very likely that residual solvents remain trapped as globules or ganglia in the vadose and saturated zones by various mechanisms. According to Pankow and Cherry, residual solvents are “extremely difficult to displace by hydraulic means alone” and indicate that residual solvents “may not always be directly accessible to flowing groundwater.” This results in dissolution becoming diffusion limited. Pankow and Cherry also say that “this results in an inherently slow mass transfer process and is often the cause of the well-known tailing phenomenon observed in remediation efforts.” In the vadose zone, residual solvents may move into a vapor phase that can transfer contaminants directly to the groundwater or to infiltrating water (Pankow and Cherry, 1996). With the exception of well R-9D, DEQ believes that the system is approaching this tailing phenomenon based upon the chloroform concentrations observed in recovery/interception wells (Maxim 2002), thereby limiting the system’s effectiveness (Appendix A, Figure 9). Since it was activated in March 2000, well R-9D has contributed approximately 55% - 71% of the total chloroform removed (Maxim 2002). According to Maxim’s most recent report (Maxim 2002), “all recovery wells are exhibiting a decreasing trend in chloroform concentrations. Therefore, the system’s annual chloroform recovery rate is also decreasing.” DEQ does not believe the pump and treat system has any affect on removing residual solvents that may remain in the vadose zone.

The IC likely to be implemented would be a CGWA, although other ICs could also be utilized. The ICs would restrict well drilling and require that deep wells be installed, along with individual treatment systems, for newly developed parcels. The CGWA would extend past the outer extents of the plume to create a buffer zone to ensure the plume does not expand through significant withdrawals of groundwater near the plume boundaries and to provide a zone of protection. Groundwater monitoring would be utilized to track the plume concentrations until cleanup levels are met.

Alternative 3:

- Individual deep replacement wells with individual treatment systems
- Groundwater monitoring
- Implementation of ICs
- Continue current pump and treat system
- Natural attenuation

Alternative 3 is similar to alternative 2 with individual replacement wells with individual treatment systems, ICs, groundwater monitoring, and natural attenuation, but also includes continuing the current pump and treat system. The individual replacement wells currently have individual treatment systems for high levels of manganese and iron, but could be adjusted to also treat for the COCs if the contamination migrated into lower units. The processes of natural attenuation would continue to decrease plume concentrations. The IC likely to be implemented would be a CGWA, although other ICs could also be utilized. The ICs would restrict well drilling and require that deep wells be installed, along with individual treatment systems, for newly developed parcels. The CGWA would extend past the outer limits of the plume to create a buffer zone to ensure the plume does not expand through significant withdrawals of groundwater near the plume boundaries and to provide a zone of protection. Groundwater monitoring would be utilized to track the plume concentrations until cleanup levels were met. Operation of the pump and treat system would be continued to contain the plume in unit A.

Alternative 4:

- CWSS
- Implementation of ICs
- Groundwater monitoring
- Natural attenuation

Alternative 4 incorporates the design and construction of a CWSS, implementation of ICs, natural attenuation, and groundwater monitoring. As part of this alternative, continued operation of the current pump and treat system, installed in unit A, would not be required because it is no longer effective in treating the contamination. Based upon assessments by various experts at sites similar to BVSL, it is likely that the laboratory solvents disposed of in the historic waste disposal pit migrated through the subsurface to the saturated zone. It is also very likely that residual solvents remain trapped as globules or ganglia in the vadose and saturated zones by various mechanisms. According to Pankow and Cherry, residual solvents are “extremely difficult to displace by hydraulic means alone” and indicate that residual solvents “may not always be directly accessible to flowing groundwater." This results in dissolution becoming diffusion limited. Pankow and Cherry also say that "this results in an inherently slow mass transfer process and is often the cause of the well-known tailing phenomenon observed in remediation efforts." In the vadose zone, residual solvents may move into a vapor phase that can transfer contaminants directly to the groundwater or to infiltrating water (Pankow and Cherry, 1996). With the exception of well R-9D, DEQ believes that the system is approaching this tailing phenomenon based upon the chloroform concentrations observed in recovery/interception wells (Maxim 2002), thereby limiting the system's effectiveness (Appendix A, Figure 9). Since it was activated in March 2000, well R-9D has contributed approximately 55% - 71% of the total chloroform removed (Maxim 2002). According to Maxim's most recent report (Maxim 2002), "all recovery wells are exhibiting a decreasing trend in chloroform concentrations. Therefore, the system's annual chloroform recovery rate is also decreasing." DEQ does not believe the pump and treat system has any affect on removing residual solvents that may remain in the vadose zone.

A CWSS would be designed, constructed and connected to each home and business within the facility boundaries, the 35 gallon per minute (gpm) pumping buffer zone boundary of the proposed CGWA, or with existing deep replacement wells. The CWSS would have the capability of providing domestic use water to current and future residents and workers. The IC likely to be implemented would be a CGWA, although other ICs could also be utilized. The ICs would restrict well drilling for domestic use and high yield wells. The CGWA would extend past the outer extents of the plume to create a buffer zone to ensure the plume does not expand through significant withdrawals of groundwater near the plume boundaries and to provide a zone of protection. If the plume migrates beyond the CWSS or IC boundaries, the CWSS or ICs will be expanded. Since irrigating lawns and food crops and filling outdoor swimming pools with contaminated groundwater at current concentrations does not present an unacceptable risk to human health (ATSDR 2001, ATSDR 2001a, and CDM 1994), after the installation of the CWSS, current and future wells within the facility boundaries could be used for irrigation purposes and filling outdoor swimming pools. The groundwater monitoring would evaluate when the groundwater reached cleanup levels through the processes of natural attenuation.

COMPARATIVE ANALYSIS OF ALTERNATIVES

Section 75-10-721, MCA, requires that DEQ evaluate and compare the cleanup alternatives based on seven specific criteria.

The cleanup alternative must:

1. protect public health, safety, welfare and the environment; and
2. meet applicable or relevant state and federal environmental requirements, criteria or limitations (ERCLs).

In addition, DEQ must select a cleanup alternative considering present and reasonably anticipated future uses, giving due consideration to institutional controls, that:

3. mitigates exposure of risks to public health, safety, and welfare and the environment;
4. is effective and reliable in the short and long-term;
5. is technically practicable and implementable;

6. uses treatment technologies or resource recovery technologies if practicable, giving due consideration to engineering controls; and
7. is cost-effective (to be determined through an analysis of incremental costs and incremental risk reduction and other benefits of alternatives considered, taking into account the total anticipated short term and long term costs of cleanup action alternatives considered, including the total anticipated cost of operation and maintenance activities).

The criteria found in the FS are based upon earlier versions of the law and the newest criteria are used for this determination. The first two criteria, overall protection of human health and the environment and compliance with ERCLs, are treated as threshold criteria. If an alternative did not meet the first two criteria, DEQ did not consider the cleanup alternative worthy of evaluation for the next five criteria. The next five criteria are evaluated to determine the best overall alternative. Comparison of cleanup alternatives for the facility was based on these seven criteria. DEQ also considered the acceptability of the cleanup to the affected community as indicated by the community members and local government. Appendix C of this ROD is a responsiveness summary that is a compilation of comments received by DEQ during the public comment period. The following sections describe how each alternative met or did not meet each of the criteria. This information is in tabular format in table 7. Table 8 is a detailed analysis of how the costs for each criteria were calculated. The costs were taken from the FS and from past work at the facility with domestic well installation and treatment system maintenance.

Alternative 1:

Although the no action alternative would comply with groundwater ERCLs because cleanup levels would be met within a reasonable amount of time through natural attenuation, the no action alternative would not meet the other threshold criteria of protection of public health, safety, welfare and the environment. There would be no safe drinking water provided to future residents and workers and no controls would be implemented to prevent people from using the contaminated groundwater. Therefore, the other criteria were not considered because protectiveness was not met.

Alternative 2:

Assuming that the individual treatment systems were properly designed and maintained, alternative 2 would protect public health, safety, and welfare because the deep domestic wells would provide contaminant-free water through the use of individual treatment systems. This alternative would protect the environment by using natural attenuation processes to bring the contaminant concentrations to cleanup levels.

The source removal action in 1994 proved very beneficial to protecting the environment. This action reduced the further contamination of the groundwater at the BVSL facility and natural attenuation will further reduce contaminant concentrations to cleanup levels. Alternative 2 meets all applicable ERCLs because within a reasonable amount of time, through natural processes, the contaminant plume will reach cleanup levels. In the short term, alternative 2 will mitigate risks to public health, safety and welfare as it eliminates human contact with contaminated groundwater. However, in the long term, DEQ believes the deep wells could be affected by contamination because the aquitards are discontinuous sedimentary features which may allow contamination to migrate down into lower units. Although individual treatment systems for the contamination could be installed, individual treatment systems are a temporary solution and require long term care. Problems associated with individual treatment systems are bacteria growth and maintenance. If the individual treatment systems are not properly maintained, bacteria will grow and the bacteria may present greater health risks than the groundwater contaminants. Some residents have experienced problems with their current individual treatment systems and some of the current individual treatment systems are not treating iron and manganese to below standards. Therefore, DEQ does not believe that individual treatment systems are effective and reliable in the long term. This alternative is technically practical and implementable because well installation and water treatment is a common practice. However, proper maintenance has proven difficult to implement. Treatment systems are a form of treatment technology and individual replacement wells with individual treatment systems are a form of engineering control. An engineering control is a method of managing environmental and health risks by placing a barrier between the contamination and the rest of the site, thus limiting exposure pathways (EPA 2002). Even though alternative 2 is more costly than alternative 4, there is no additional risk reduction than in alternative 4. Long term risk may actually be increased due to long term maintenance issues associated with individual treatment systems. At a cost of about $5,748,327, alternative 2 is not cost-effective compared to alternative 4.

Alternative 3:

Assuming that the individual treatment systems were properly designed and maintained, alternative 3 would protect public health, safety, and welfare because the deep domestic wells would provide contaminant-free water through the use of individual treatment systems. This alternative would protect the environment by using natural attenuation processes to bring the contaminant concentrations to cleanup levels.

The source removal action in 1994 proved very beneficial to protecting the environment. This action reduced the further contamination of the groundwater at the BVSL facility. Alternative 3 meets all applicable ERCLs because within a reasonable amount of time, the contaminant levels in the water will naturally attenuate to cleanup levels. In the short term, alternative 3 is effective, reliable and mitigates the exposure of risks to public health, safety and welfare. However, in the long term, DEQ believes the deep wells could be affected by contamination because the aquitards are discontinuous sedimentary features which may allow the contamination to migrate down to lower units. In addition, the current pump and treat system does not contain contamination primarily east of Highway 93. Individual treatment systems for the contamination could be installed, but individual treatment systems are a temporary solution and require long term care. Problems associated with individual treatment systems are bacteria growth and maintenance. If the individual treatment systems are not properly maintained, bacteria will grow and this bacterium may present greater health risks than the groundwater contaminants. Some residents have experienced problems with their current individual treatment systems and some of the current individual treatment systems are not treating iron and manganese to below standards. Proper maintenance has proven difficult to implement. Therefore, DEQ does not believe that individual treatment systems are effective and reliable in the long term. Engineering controls with this alternative include the pump and treat system and individual replacement wells. Operation of the pump and treat system would be continued to contain the plume in unit A. Pump and treat is also a form of treatment technology. This alternative is implementable because well installation is a common practice. Even though alternative 3 is more costly than alternative 4, there is no additional risk reduction over alternative 4. Long term risk may actually be increased due to long term maintenance issues associated with individual treatment systems. At a cost of about $7,798,244, alternative 3 is not as cost-effective compared to the other alternatives.

Alternative 4:

Alternative 4 protects public health, safety, and welfare and the environment. Alternative 4 provides protection of human health through the construction of a CWSS in conjunction with ICs and would provide a clean source of water while eliminating unacceptable contact with contaminated groundwater to all current and future BVSL workers and residents. This alternative would protect the environment by using natural attenuation processes to bring the contaminant concentrations to cleanup levels.

The source removal action in 1994 proved very beneficial to protecting the environment. This action reduced the further contamination of the groundwater at the BVSL facility. Alternative 4 also meets all applicable ERCLs because within a reasonable amount of time, the processes of natural attenuation will bring the contaminant levels to cleanup levels. A CWSS would be effective in the short term and long term because the water would come from outside the plume of contamination. Current and future residences and businesses would also connect to the CWSS, providing them with clean, safe drinking water and ICs would limit the uses and yields of new wells. The installation of a CWSS uses standard water well and piping construction practices and therefore would be technically practicable and fairly easy to implement. This alternative does not use treatment technologies or resource recovery technologies because continued operation of the pump and treat system would not be required. However, this alternative gives due consideration to engineering controls, because a CWSS is a form of engineering control. This alternative provides the highest risk reduction at a cost lower than the other alternatives. At a cost of about $956,085, installing a CWSS with ICs and groundwater monitoring would be cost-effective.

TABLE 7
COMPARISON OF ALTERNATIVES USING CECRA CRITERIA

	Protects public health, safety, welfare and the environment	Complies with ERCLs	Mitigates exposure of risks to public health, safety, and welfare and the environment	Effective and reliable in the short- and long-term	Technically practicable and implementable	Uses treatment technologies, resource recovery technologies or engineering controls	Cost-effective	Current community acceptance
<u>Alternative 1</u> • No Action	NO	YES	NE	NE	NE	NE	NE	NE
<u>Alternative 2</u> • Replacement wells with individual treatment systems • Groundwater monitoring • ICs	YES	YES	SHORT-TERM – YES LONG-TERM – NO	NO	YES	YES	NO	NO PREFER-ENCE INDICATED
<u>Alternative 3</u> • Replacement wells with individual treatment systems • ICs • Groundwater monitoring • Pump and treat	YES	YES	SHORT-TERM – YES LONG-TERM – NO	NO	YES	YES	NO	NO PREFER-ENCE INDICATED
<u>Alternative 4</u> • Community Water supply System • ICs • Groundwater monitoring	YES	YES	YES	YES	YES	YES	YES	YES

NE = Not Evaluated

TABLE 8
ALTERNATIVES COST ANALYSIS

Alternative 1
Cost = $0

Alternative 2

Year	Item	Quantity	Cost per Item per Year	Total Cost
Initial Capital Costs				
1	Deep domestic wells	84	$40,000	$3,360,000
	Engineering and Design @ 20%	1	$672,000	$672,000
	Administrative Costs @ 15%	1	$504,000	$504,000
	Installation of treatment systems ($1800 for system/$200 for installation)	84	$2000	$168,000
Total Capital Costs for Year 1				*$4,704,000*
Operation and Maintenance Costs				
1-30	Well Monitoring		$13,500	$13,500
1-30	Limited Monitoring/Reporting		$10,000	$10,000
1-30	Maintenance of Treatment Systems	103*	$400	$41,200
	Total for 1 Year of O & M			$64,700
Present Worth of 30 Years of O & M @ 5%				*$1,044,327*
Total Cost for Alternative 2				**$5,748,327**

*existing treatment systems plus 84 new

Alternative 3

Year	Item	Quantity	Cost per Item per Year	Total Cost
Initial Capital Costs				
1	Deep domestic wells	84	$40,000	$3,360,000
	Engineering and Design @ 20%	1	$672,000	$672,000
	Administrative Costs @ 15%	1	$504,000	$504,000
	Installation of treatment systems ($1800 for system/$200 for installation)	84	$2000	$168,000
Total Capital Costs for Year 1				*$4,704,000*
Operation and Maintenance Costs				
1-30	Well Monitoring		$13,500	$13,500
1-30	Facility Monitoring/Reporting		$37,000	$37,000
1-30	Maintenance of Treatment Systems	103*	$400	$41,200
1-30	Pump and Treat System O & M		$100,000	$100,000
	Total for 1 Year of O & M			$191,700
Present Worth of 30 Years of O & M @ 5%				*$3,094,244*
Total Cost for Alternative 3				**$7,798,244**

*existing treatment systems plus 84 new

Alternative 4

Year	Item	Quantity	Cost per Item per Year	Total Cost
Initial Capital Costs				
1	Community Water Supply System	1	$588,648	$588,648
	Engineering and Design @ 20%	1	$117,730	$117,730
	Administrative Costs @ 15%	1	$88,297	$88,297
Total Capital Costs for Year 1				*$794,675*
Operation and Maintenance Costs*				
1-30	Limited Monitoring/Reporting		$10,000	$10,000
	Total for 1 year of O & M			$10,000
Present Worth of 30 Years of O & M @ 5%				*$161,410*
Total Cost for Alternative 4				**$956,085**

*Does not include O & M costs for CWSS

SELECTED ALTERNATIVE

The alternatives described in the previous section are considered the most appropriate and feasible options available at this time. During the early stages of work and development of the FS, numerous other cleanup alternatives were discussed and evaluated. However, at that time it was determined that all but a few of the cleanup options were either impractical or not feasible due to either cost or technological weaknesses. The long list of alternatives in the FS was narrowed to a select few remedies. In compliance with CECRA requirements and with consideration of public comments received, DEQ evaluated these cleanup alternatives and decided upon alternative 4 as the selected alternative.

Main components of the selected alternative include:

- CWSS
- Natural attenuation
- Groundwater monitoring until cleanup levels are achieved
- Implementation of ICs

<u>CWSS</u>

The CWSS will be designed and constructed by NIH. Prior to establishing the CWSS, groundwater outside the proposed CGWA will be analyzed to determine its suitability for domestic use. NIH will connect the CWSS to each home and business within the facility boundaries, the 35 gpm pumping buffer zone boundary of the proposed CGWA, or with existing deep replacement wells. Any homes or businesses constructed after issuance of the ROD will be responsible for their own connection fees. Current wells may continue to be used for non-domestic purposes such as irrigation and swimming pool water (ATSDR 2001, ATSDR 2001a, and CDM 1994). The CWSS will consist of a well field, treatment facilities, storage tank, distribution lines and service connections to the affected properties. The system will be designed to have a reserve capacity of 30% for unscheduled maintenance, unscheduled outages and short term growth. The system will be designed for future growth, although new residences and businesses will be responsible for their own connection. Water supply wells, treatment and storage facilities will be designed to provide minimum operating pressure of 35 pounds per square inch to 103 parcels, determined to be the number of parcels that would exist if all property within the facility were divided up into half-acre parcels. NIH is not required to design the CWSS to provide fire flow.

The first phase of the CWSS is the design phase. NIH will submit a design plan to DEQ. The system must meet all regulatory requirements of a "community water system" under Administrative Rules of Montana Title 17, Chapter 38 and the SDWA. DEQ's Public Water Supply Section must review the design plan before any construction ensues.

A legal entity must be formed by the residents to own and operate the CWSS. Once the CWSS is constructed and connected to residences and businesses, ownership and control of the system will be turned over to the legal entity formed by the residents. An attorney may be retained to prepare the corporate and other documents necessary to create the appropriate legal entity. The entity will obtain and own the easements, the property for the wells, and water rights necessary for construction of the system. NIH will pay the fees for an attorney to help set up the legal entity and will set aside $100,000 for formation of the entity and obtaining the property, easements and water rights. The legal entity will be organized such that it has appropriate power to assess users for the normal day to day costs of owning and operating the system. After DEQ issues the Certificate of Completion, the legal entity will be responsible for the CWSS's long term operation and maintenance. The legal entity will also be responsible for monitoring the

CWSS and must conduct water sampling by a certified operator according to DEQ's Public Water Systems Sample Requirements. A copy of these requirements is contained in Appendix E.

Once the design plan is approved by DEQ and all requirements are met, NIH shall initiate the procurement of a contractor to construct the CWSS. NIH shall require the construction contractor to provide an appropriate warranty to the legal entity warranting workmanship and that the CWSS is free from material defects. The period of the warranty shall be one year from the date DEQ issues a Certificate of Completion for the CWSS and the legal entity will have the responsibility to pursue warranty issues with the construction contractor (DEQ 2000). The legal entity will operate the CWSS after construction and connection are completed. The CWSS will be owned by its users who will pay water bills as established by the legal entity. If the plume expands, DEQ will request that NIH connect newly affected water users to the CWSS. NIH will be responsible for these additional connections for ten years after the later of the termination of the pump and treat system or the issuance of the Certificate of Completion (DEQ 2000). If the plume expands after this ten year period, DEQ will connect newly affected water users who are in compliance with ICs to the CWSS utilizing funds provided by the PLPs.

Natural Attenuation

Natural attenuation is an in-situ treatment method utilizing natural processes, such as biodegradation, dilution, dispersion, and adsorption, to reduce the contaminant concentrations. Natural attenuation is discussed in more detail in the Facility Characteristics section. Through natural attenuation, cleanup levels will be met within a reasonable amount of time. DEQ will review future monitoring data to verify that natural attenuation is continuing and is effective at reducing contaminant concentrations.

Groundwater Monitoring

NIH will install five new monitoring wells to help better track the plume and to verify that natural attenuation is continuing to clean up the plume. The new monitoring wells will be placed outside the current perimeter of the plume to monitor for possible plume expansion. Ten monitoring wells total will be sampled semi-annually until cleanup levels are met. The samples will be analyzed for VOCs using EPA method 524.2. The data collected will be provided to DEQ after each sampling event for review. DEQ will review the data to analyze the effectiveness of natural attenuation to reduce contaminant concentrations and watch for plume expansion. If the plume expands, DEQ will request that NIH install new monitoring wells, as necessary. NIH will be responsible for groundwater monitoring for five years after the later of the termination of the pump and treat system or the issuance of the Certificate of Completion (DEQ 2000). After this five year period, DEQ will perform the groundwater monitoring tasks until cleanup levels are achieved utilizing funds provided by the PLPs.

ICs

ICs will be implemented to limit the exposure of residents and workers to contaminated water. DEQ's preferred IC is a CGWA. DEQ must present the data to support the CGWA to the Montana Department of Natural Resources and Conservation (DNRC). DNRC has the authority to issue the order. Once DEQ files a petition with supporting documentation, DNRC will review the data, hold a public hearing and accept public comment before making a final decision. A map of the proposed CGWA is contained in Appendix F. The map contains two boundary lines. Inside the blue line, no domestic wells could be drilled in any unit. Between the blue and red lines, only wells that yield 35 gpm or less could be drilled in units A and B (Weight 2001). If DNRC does not issue an order for a CGWA, DEQ will require the implementation of other ICs as appropriate to restrict the use of contaminated groundwater.

Some wells that are not contaminated today have the potential to become contaminated in the future. If a well is inside the proposed CGWA, the pumping of that well may affect plume expansion. The pumping action may expand the plume by drawing contaminated water toward it to the point that the well becomes contaminated. Each home and business within the facility boundaries, the 35 gpm pumping buffer zone boundary of the proposed CGWA, or with existing deep replacement wells will be required to connect to the CWSS.

DEQ is requiring that additional restrictions be placed on the landfill property. A complete copy of those restrictions is contained in Appendix H. In addition to limiting human exposure to contaminated groundwater, ICs on the landfill property will preserve the protective cap and prohibit irrigation.

STATUTORY DETERMINATIONS

Section 75-10-721, MCA, requires that the selected alternative chosen by DEQ meet the criteria outlined in the previous section. The following text describes how the selected alternative meets the requirements outlined in § 75-10-721, MCA. The selected alternative is evaluated considering each criterion.

DEQ has determined that the selected alternative will satisfy all the requirements outlined in § 75-10-721, MCA as follows:

1. **The combined alternative attains a degree of cleanup of the hazardous or deleterious substance and control of a threatened release or further release of that substance that assures protection of public health, safety, and welfare and of the environment.**

To eliminate the potential of future releases of contaminants to the groundwater, highly contaminated soil was effectively removed in 1994. As an interim action, this task proved to be extremely beneficial to the overall long term goal of protecting human health and the environment by reducing any further contamination of the groundwater. Within a reasonable amount of time, through natural attenuation processes, the contaminant levels in the groundwater will be reduced to cleanup levels. To reduce current and future threats to public health, the construction of a CWSS will provide a clean source of water to current and future facility residents and workers.

In conjunction with the CWSS, the selected alternative incorporates ICs. To protect current and future facility residents and workers from coming into contact with contaminated groundwater, ICs will limit the installation of domestic use and high yield wells. As part of the selected alternative, the continued operation of the current pump and treat system is not required. Current and future wells within the facility boundaries may be used for irrigation purposes and filling swimming pools because using contaminated groundwater for these purposes at current concentrations does not present an unacceptable risk to human health or the environment.

Monitoring will be conducted to evaluate if the plume migrates beyond the CWSS or IC boundaries. If the plume expands, this remedy provides for the expansion of the CWSS or ICs to ensure protectiveness for future facility residents and workers.

2. <u>The combined alternative achieves cleanup consistent with applicable or relevant state or federal environmental requirements, criteria, or limitations.</u>

The selected alternative will comply with applicable and relevant state and federal ERCLs. An analysis of the ERCLs is contained in Appendix G. Within a reasonable amount of time, the process of natural attenuation will reduce contaminant levels to cleanup levels. Groundwater monitoring will be conducted to monitor how the process is reducing contaminant levels. Groundwater monitoring will continue until cleanup levels are met. If the plume migrates beyond the CWSS or IC boundaries, the CWSS or ICs will be expanded. The CWSS will comply with all applicable laws, including the regulatory requirements for a community water system under the Administrative Rules of Montana Title 17, Chapter 38 and the SDWA.

3. <u>The selected remedial action performed shall consider present and reasonably anticipated future uses, giving due consideration to institutional controls, that:</u>

(a) <u>demonstrate acceptable mitigation of exposure to risks to the public health, safety, and welfare and the environment;</u>

The residential population within the facility boundary has the potential to increase. To be protective of current, as well as future, residents and workers in the area, ICs such as a CGWA will be implemented to prevent drilling of domestic drinking water and high yield wells within the IC boundaries, thus eliminating unacceptable human exposure to contaminated groundwater.

A CWSS will be installed, providing an ample source of clean water to all current and potential future residents and workers. The implementation of the CWSS will provide residents and workers with a source of clean water for all domestic purposes, eliminating the unacceptable risk of exposure to contaminated groundwater. Current and future wells within the facility boundaries may be used for irrigation purposes and filling swimming pools. If the plume expands, this remedy provides for the expansion of the CWSS or ICs to ensure mitigation of exposure to risks for future facility residents and workers.

The source removal action in 1994 proved beneficial to mitigating exposure of risks to the environment by reducing further contamination to the groundwater. This alternative will continue to demonstrate acceptable mitigation of risks to the environment through natural attenuation processes.

(b) <u>are effective and reliable in the short term and long term;</u>

The current domestic deep replacement wells and individual treatment systems will be monitored and operational during the construction of the CWSS. Once complete, the CWSS in conjunction with ICs will provide a clean source of water and prevent exposure to contaminated groundwater to all current and future BVSL facility residents and workers. To ensure that those properties located on the fringe of the contaminant plume are protected in the long term, a buffer zone will be established. The buffer zone will surround the contaminant plume and be of adequate width to minimize plume expansion through significant withdrawals of groundwater near the plume boundaries and to protect these users in the event the plume changes shape or expands beyond its current size.

Furthermore, groundwater monitoring will be conducted and data will be reviewed until cleanup levels are met throughout the facility. The edges of the contaminant plume will be monitored to evaluate if the contaminant plume migrates beyond facility boundaries. As stated above, if the contaminant plume does migrate beyond facility boundaries, the CWSS or ICs will be expanded.

(c) <u>are technically practicable and implementable;</u>

The focus of the selected alternative involves the establishment of the CWSS. The CWSS has proven to be an implementable method in providing a clean source of water to residents in other communities. To ensure protection, prior to installation, the CWSS will go through thorough engineering design and analysis and will be reviewed by DEQ's public water supply program to ensure it meets specifications. The CWSS will be developed to provide clean water to the current and future residents and workers. Clean groundwater outside the facility will be used for the CWSS. The chosen source area will be tested for suitability prior to installation of the CWSS. Once the CWSS source area is established, clean water will be delivered to homes and businesses via underground piping. Piping will be installed and connected under the oversight of professional engineers and DEQ. Groundwater monitoring is also practicable and implementable.

<u>(d) use treatment technologies or resource recovery technologies if practicable, giving due consideration to engineering controls; and</u>

DEQ's selected alternative focuses on protecting current and future facility residents from exposure to contaminated water for the short term and long term and the CWSS is the only current technology available that will assure this degree of protection. As a proven technology that is used commonly throughout the country, a CWSS in conjunction with ICs is the most practicable technology available to achieve the goal of protecting human health. Currently, there is no technology that is cost-effective or technically practical that will treat the contaminated groundwater, although a CWSS is also a form of engineering control.

(e) <u>are cost-effective</u>.

The overall cost includes the estimated capital costs and operation and maintenance costs of the alternative for 30 years. Cost-effectiveness is determined through an analysis of incremental costs and incremental risk reduction and other benefits of alternatives considered, taking into account the total anticipated short term and long term costs of remedial action alternatives considered, including the total anticipated cost of operation and maintenance activities. This alternative is cost-effective because it provides the highest degree of protection of current and future residents and workers at the lowest cost. The selected alternative will cost approximately $956,085. Table 8 gives a breakdown of this cost. The costs were taken from the FS.

The information in the cost estimate summary table is based on the best available information regarding the anticipated scope of the cleanup alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the cleanup alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an explanation of significant differences or a ROD amendment.

ESTIMATED OUTCOMES OF THE SELECTED ALTERNATIVE

The estimated outcome of the selected alternative is that in the future there will be unrestricted groundwater use. Until that time, residents and workers will have a clean drinking water supply from the CWSS. The available land use of the landfill, after cleanup has been completed, will be restricted to pasture or open space. The solid waste program at DEQ requires that once a landfill is capped and closed, the cap cannot be destroyed and vegetation must remain on the cap at all times (DEQ 2001a). The available use of the remainder of the facility will be residential and industrial without limitations after the cleanup levels are met.

DOCUMENTATION OF SIGNIFICANT CHANGES FROM THE PREFERRED ALTERNATIVE OF PROPOSED PLAN

No significant changes of the preferred alternative have occurred in choosing the selected alternative.

GLOSSARY

Administrative Record: all files and documents used to select a cleanup alternative at a Superfund facility.

Carcinogens: cancer-causing substance or agent.

Cleanup Action: Those activities undertaken by the liable person(s) in accordance with the final cleanup design accepted by DEQ.

Community Water Supply System (CWSS): a public water supply system owned by the residents, which provides water for domestic purposes for year-round use by area residents.

Comprehensive Environmental Cleanup and Responsibility Act (CECRA): Montana's Superfund law that addresses the cleanup of contamination from hazardous or deleterious substances that have been released or present a threat of release into the environment and pose a threat to human health and the environment.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): Federal Superfund law which addresses the remediation of contamination from hazardous substances that have been released or present a threat of release into the environment and pose a threat to human health and the environment.

Contamination: the presence of hazardous or deleterious substances in environmental media.

Dense non-aqueous phase liquid (DNAPL): product that is denser than water and therefore sinks when it reaches with water.

Ecological Risk Assessment: evaluates the chance that adverse affects may occur or are occurring to plants, animals and other organisms at the facility as a result of exposure to the contaminants.

Engineering Controls: method of managing environmental and health risks by placing a barrier between the contamination and the rest of the site, thus limiting exposure pathways (EPA 2002).

Environmental Requirements, Criteria or Limitations (ERCLs): Federal and State environmental laws and regulations that must be met during cleanup.

Facility: any site or area where hazardous or deleterious substances have come to be located.

Groundwater: water located below the earth's surface.

Baseline Human Health Risk Assessment: a process for taking information about how people live and work and how they might be exposed to contaminated material, combining it with information about how contaminants may affect people, and using equations to estimate the chance that people will get cancer or other illnesses from that exposure.

Institutional Controls: restrictions on the use of property that mitigate the risk posed to public health, safety and welfare and the environment. ICs may include deed restrictions, building restrictions, easements, reservations, restrictive covenants, affirmative covenants, and controlled groundwater areas.

Natural Attenuation: an in-situ treatment method that utilizes natural processes, such as biological degradation, dilution, and adsorption, to reduce the contaminant concentrations.

National Institutes of Health (NIH): an operating division of the United States Department of Health and Human Services.

Operation and Maintenance (O&M): all activities required to operate and maintain the effectiveness of the cleanup action.

Plume: groundwater impacted by contaminants of concern.

Potentially Liable Person (PLP): individual or other entity who may be responsible for cleanup under CECRA law.

Pump and Treat System: process where contaminated groundwater is pumped through wells to the surface, treated, and discharged back to the environment.

Record of Decision (ROD): a public document that explains which cleanup alternative will be used at a Superfund facility. The ROD includes the agency's rationale for choosing an alternative.

ACRONYMS

ATSDR – Agency for Toxic Substances and Disease Registry
bgs –below ground surface
BVSL – Bitterroot Valley Sanitary Landfill
CECRA – Comprehensive Environmental Cleanup and Responsibility Act
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
CGWA – controlled groundwater area
COC – contaminant of concern
CWSS – community water supply system
DEQ – Montana Department of Environmental Quality
DHES – Montana Department of Health and Environmental Sciences
DNAPL – dense non-aqueous phase liquids
DNRC – Department of Natural Resources and Conservation
EPA – United States Environmental Protection Agency
ERA – ecological risk assessment
ERCLs – environmental requirements, criteria or limitations
FS – feasibility study
HI – hazard index
IC – institutional control
MCA – Montana Code Annotated
MCL – maximum contaminant level
mg/kg – milligrams per kilogram
mg/L – milligrams per liter
NIH – National Institutes of Health
NPL – National Priority List
O&M – operation and maintenance
PAA – Preliminary Alternative Analysis
PLP – potentially liable person(s)
PRG – preliminary remediation goal
RA – risk assessment
RfD – reference dose
RME – reasonable maximum exposure
ROD – Record of Decision
SSL – soil screening level
VOC – volatile organic compound
WQB-7 – Montana water quality standards
μg/L – micrograms per liter

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